FOREST PEST MANAGEMENT
Pacific Southwest Region

FPM Report No. C96-3 38,62212 -120,47849 3420
June 28, 1996

INSECTS AND PATHOGENS IN A LOW ELEVATION PINE PLANTATION ON THE AMADOR RANGER DISTRICT, ELDORADO NATIONAL FOREST

John Pronos, Plant Pathologist
John Wenz, Entomologist

Plantation No. 140-1 in the Scott Creek Compartment, Amador Ranger District, was visited on May 29, 1996. Personnel present included: Dave Bakke, Silviculturist, Eldorado NF; John Wenz, Entomologist and John Pronos, Plant Pathologist from the Forest Pest Management Shared Service Area Office in Sonora, CA. Small pockets of tree mortality in the plantation were first noticed this spring. The objectives of this evaluation were to identify the causes of mortality and provide options for managing the stand/plantation.

The site is at 3700 feet elevation and was planted to ponderosa pine in March, 1987 following a clear cut the previous year. Most pines are now between 6 and 10 feet in height and from 2-4 inches DBH. Site class is a Dunning I. The surrounding stand is almost all ponderosa pine from 20 - 32 inches DBH, and contains an occasional Douglas-fir, incense-cedar, sugar pine, and California black oak.

OBSERVATIONS/DISCUSSION

Pine mortality included trees that were currently fading plus trees that had died within the past few years. All mortality spots contained stumps between 26 and 38 inches diameter. Several of the largest stumps were examined and found to contain viable conks of Heterobasidion annosum, the cause of annosus root disease. Samples of root wood from dying ponderosa pine seedlings were collected, cultured, and found to be colonized by H. annosum. Because all stumps present were ponderosa pine, and all mortality was in pine, we concluded that only the "P" type of annosus root disease is affecting the site. Refer to the "Pest Biology" descriptions at the end of this report for more information on the two "types" of annosus root disease.

The fact that: (1) the 1987 sale harvested living trees, (2) it took about 6 years for seedling mortality to show up, and (3) no root disease was found in adjacent stands, all suggest that annosus root disease was not established

United States Department of Agriculture
Forest Service
Stanislaus National Forest
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Sonora, CA 95370-5909

File Code: 3420
Route To:

Date: JUL 11 1996

Subject: Tree Mortality in Pine Plantations

To: Forest Supervisor, Eldorado NF C 96-3

The enclosed report deals with tree mortality in one ponderosa pine plantation on the Amador Ranger District. The situation there, and management alternatives, may have application in similar plantations throughout the Eldorado Forest. Please direct any questions or requests for additional information to our Forest Pest Management Shared Service Area personnel here in Sonora at (209) 532-3671.

for JANET L. WOLD
Forest Supervisor

Enclosure

cc. Dave Bakke, Eldorado SO
John Kliejunas, RO-S&PF

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FS-6200-28b (12/93)

on the site prior to cutting, and that this pathogen most likely invaded stumps cut during the 1987 sale. Stumps were not treated with any borate compound in 1987.

Pine reproduction weevil, Cylindrocopturus eatoni (Coleoptera: Curculionidae), was found associated with mortality of small (< 4 feet in height) pines that had seeded into the plantation from natural seed sources. This mortality occurred as single trees and small groups scattered throughout the plantation (see Pest Biologies in the Appendix).

MANAGEMENT OPTIONS

1. NO ACTION. Left untreated, annosus root disease will continue to kill pines within the current mortality centers, but should not expand much beyond the existing boundaries of the centers. The pathogen will remain active within the root zone of infected residual pine stumps. Plantation saplings do not have root systems large enough to spread the disease or serve as a future reservoir for the pathogen. Pine reproduction weevil may continue to cause scattered mortality over the next two years to natural pine reproduction <5 feet in height, but should not affect the taller reproduction.

2. THINNING. The plantation is at a stage where the District is considering thinning. This should not have any significant effect on annosus root disease, and normal thinning can be done in areas outside mortality centers. However, because root disease will likely kill additional trees within centers, it may be best to not thin these spots, but wait to see which, and how many, trees survive.

3. RESISTANT SPECIES. Because the affected site is at a low elevation and almost pure ponderosa pine, managing for or planting resistant conifer species may not offer a realistic alternative. Species resistant to this type of H. annosum include Douglas-fir, giant sequoia, and white fir.

4. PREVENTION/SPORAX. Treating freshly cut stumps with Sporax (sodium tetraborate decahydrate) is common practice in eastside pine stands where annosus root disease is well established, widespread, and damaging. This is not the case in low elevation westside pine stands where annosus root disease is infrequent and sporax treatment is the exception rather than the rule. At this time we do not know whether the root disease in Plantation 140-1 is an anomaly, or if it represents a pattern of increasing root disease. The Eldorado Forest should try and determine if mortality and root disease are present in other similar pine plantations. In the meantime, it is advisable to consider using Sporax in all sales within one mile of this plantation. Inoculum (spores) of H. annosum are probably present over much of the Forest at low levels, but this plantation contains viable conks which could provide a significant, localized source of increased inoculum.

APPENDIX

Biologies of Pest Organisms

Annosus Root Disease of Pine

Heterobasidion annosum (formerly Fomes annosus) is a fungus that attacks a wide range of woody plants, causing a decay of the roots and lower bole and death of sapwood and cambium. All pines in California are susceptible; hardwoods are rarely affected.

The fungus becomes established in freshly cut stumps from air-borne spores produced by fruiting bodies (conks). It then grows into the root system and may spread to adjacent healthy trees via root contacts. Infected pines are usually killed rather rapidly when H. annosum girdles the root collar. After several years, conks are produced under the bark of dead trees, in decayed stumps, or in the duff at the root collar (only under very wet conditions).

Local spread of H. annosum outward from a stump results in the formation of disease centers that have dead trees in the middle and dying trees on the margin. With mature size trees, these centers usually continue to enlarge until they reach barriers such as openings or groups of non-host plants. The fungus may remain alive for as long as 50 years as a saprophyte in infected roots and stumps. Pines may seed in or be planted in centers and survive for a few years, but they eventually will be infected and die.

There are two pathogenic strains of the fungus that differ in their ability to infect various conifers in California. The "P" or pine type infects and kills all pines (although susceptibility of pine species vary), in addition to incense-cedar and western juniper. The "S" or fir type infects true fir, giant sequoia, and probably Douglas-fir. Knowing which type is active in a stand will allow favoring alternate conifer species since the strains do not cross infect between the two groups listed above.

Pine Reproduction Weevil

The pine reproduction weevil, Cylindrocopturus eatoni (Coleoptera: Curculionidae), is primarily a pest of pine plantations occurring under 4,500 feet in elevation in northern and central California. Ponderosa and sugar pines are the main hosts; Jeffrey pine may also be attacked when planted within the range of ponderosa pine.

The pine reproduction weevil completes a life cycle in one year. The adults (about 2.5 mm in length) emerge from infested trees from late-May to mid-July. They feed on pine foliage, twigs and stems for about two to three weeks after which they lay eggs, singly, in feeding punctures on the main stem below the current year's growth. The eggs hatch in about two weeks and the larvae bore into the cambium-phloem area where they feed until fall when they construct

pupal chambers in the outer layers of the wood or in the pith of smaller diameter stems. They overwinter as mature larvae in the pupal chambers and pupate the next spring. The pupal stage lasts about two weeks after which the next-generation adults emerge to complete the cycle.

Attack is usually restricted to pines between about 18 inches to 5 feet in height although occasionally trees up to about 10 feet in height are affected. Infested trees become evident in late-summer and fall with the entire tree fading to brown from the top down. Sometimes only the upper part of the tree is attacked and killed but frequently such trees will be re-attacked and killed the following year. Infested trees can also be identified by circular adult feeding punctures on the needles and stems. Most problems with pine reproduction weevil have occurred in plantations suffering heavy competition from competing vegetation. Under such conditions, infestations can persist for several years and virtually destroy the entire plantation. Maintaining suitable growing conditions in plantations is the most effective means to prevent pine reproduction weevil impacts.